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Demonstration of Particulate Matter (PM) Sensor in Post-DPF Environment
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## Abstract

The use of after-treatment and engine control systems for diesel engines to achieve low emissions has created a need for functional measurement systems to verify correct operational performance during vehicle operation and to provide an unambiguous indication if onboard diagnostic (OBD) levels are exceeded.

The purpose of this program was to reconfigure the Honeywell particulate mass (PM) sensor concept from its previous configuration as a sensor for measuring the particle concentration directly out of the engine, to a mass concentration sensor for operation in the post-diesel particulate filter (DPF) environment of a diesel engine's aftertreatment system. Under the California Air Resources Board (CARB)-sponsored Innovative Clean Air Technologies (ICAT) Grant program, Honeywell tested and demonstrated the operation of the PM sensor in the post-DPF environment and assessed its ability to detect low particle concentrations downstream of the DPF. A key goal of the program was to determine if the particulate matter (PM) sensor could measure particulate matter levels below the OBD threshold of 0.03 g/bhp-hr. Particle and charge measurements in the post-DPF environment were conducted during this program to correlate with the response of the PM sensor.

The PM sensor was found to detect particle mass concentrations at levels below 0.03 g/bhp-hr. The sensor was also shown to withstand the harsh conditions in this environment, such as high temperature. However, intrinsic vibration of the exhaust system during operation of the diesel engine was found to affect the sensor response and limit the signal-to-noise ratio of the sensor's output, thus minimizing the effectiveness of a single sensor directly downstream of the DPF.

Data analysis indicates that modifications to the signal processing algorithm may improve the detection of a DPF failure either if a single PM sensor is used in conjunction with other engine parameters or if a second PM sensor is used to measure the mass concentration upstream of the DPF.